

FORM PTO-1390
(REV 10-2000)

U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE

ATTORNEY'S DOCKET NUMBER

6157-01WOUS

**TRANSMITTAL LETTER TO THE UNITED STATES
DESIGNATED/ELECTED OFFICE (DO/EO/US)
CONCERNING A FILING UNDER 35 U.S.C. 371**

INTERNATIONAL APPLICATION NO.
PC/EP00/06176INTERNATIONAL FILING DATE
July 3, 2000U.S. APPLICATION NO. (If known, see 37 CFR 1.5)
10/031,714

TITLE OF INVENTION GAS WIPING NOZZLE FOR A WIRING COATING APPARATUS

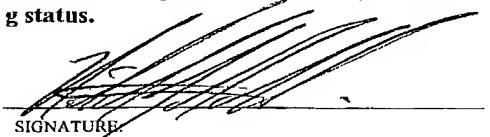
APPLICANT(S) FOR DO/EO/US
TREFILARBED BISSEN S.A.

Applicant hereby submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information.

1. This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. This is an express request to promptly begin national examination procedures (35 U.S.C. 371(f)).
4. The U.S. has been elected by the expiration of 19 months from the priority date (PCT Article 31).
5. A copy of the International Application as filed (35 U.S.C. 371(c)(2))
 - a. is attached hereto (required only if not communicated by the International Bureau).
 - b. has been communicated by the International Bureau.
 - c. is not required, as the application was filed in the United States Receiving Office (RO/US).
6. An English language translation of the International Application as filed (35 U.S.C. 371(c)(1)).
7. Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3))
 - a. are attached hereto (required only if not communicated by the International Bureau).
 - b. have been communicated by the International Bureau.
 - c. have not been made; however, the time limit for making such amendments has NOT expired.
 - d. have not been made and will not be made.
8. An English language translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
9. An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)).
10. An English language translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).

Items 11 to 16 below concern document(s) or information included:

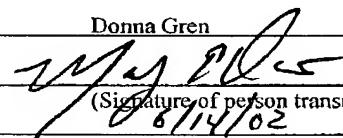
11. An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
12. An Assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
13. A FIRST preliminary amendment.
- A SECOND or SUBSEQUENT preliminary amendment.
14. A substitute specification.
15. A change of power of attorney and/or address letter.
16. Other items or information:
 1. PCT/IPEA/416 & PCT/IPEA/409.
 2. PCT/IB/308.
 3. PCT/ISA/210.
 4. PCT/IB/304

U.S. APPLICATION NO (if known, see 37 CFR 1.5) 10 031,714	INTERNATIONAL APPLICATION NO. PCT/EP00/06176	ATTORNEY'S DOCKET NUMBER 6157-01WOUS																
<p>17. <input checked="" type="checkbox"/> The following fees are submitted:</p> <p>BASIC NATIONAL FEE (37 CFR 1.492 (a) (1) - (5) :</p> <p>Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO and International Search Report not prepared by the EPO or JPO \$1000.00</p> <p>International preliminary examination fee (37 CFR 1.482) not paid to USPTO but International Search Report prepared by the EPO or JPO \$860.00</p> <p>International preliminary examination fee (37 CFR 1.482) not paid to USPTO but international search fee (37 CFR 1.445(a)(2)) paid to USPTO \$710.00</p> <p>International preliminary examination fee paid to USPTO (37 CFR 1.482) but all claims did not satisfy provisions of PCT Article 33(1)-(4) \$690.00</p> <p>International preliminary examination fee paid to USPTO (37 CFR 1.482) and all claims satisfied provisions of PCT Article 33(1)-(4) \$100.00</p>		CALCULATIONS PTO USE ONLY																
ENTER APPROPRIATE BASIC FEE AMOUNT =		\$ 860.00																
Surcharge of \$130.00 for furnishing the oath or declaration later than <input type="checkbox"/> 20 <input type="checkbox"/> 30 months from the earliest claimed priority date (37 CFR 1.492(e)).		\$																
<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 15%;">CLAIMS</th> <th style="width: 30%;">NUMBER FILED</th> <th style="width: 30%;">NUMBER EXTRA</th> <th style="width: 25%;">RATE</th> </tr> </thead> <tbody> <tr> <td>Total claims</td> <td>12 - 20 =</td> <td>0</td> <td>X \$18.00</td> </tr> <tr> <td>Independent claim:</td> <td>1 - 3 =</td> <td>0</td> <td>X \$80.00</td> </tr> <tr> <td colspan="2">MULTIPLE DEPENDENT CLAIM(S) (if applicable)</td> <td></td> <td>+ \$270.00</td> </tr> </tbody> </table>		CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE	Total claims	12 - 20 =	0	X \$18.00	Independent claim:	1 - 3 =	0	X \$80.00	MULTIPLE DEPENDENT CLAIM(S) (if applicable)			+ \$270.00	\$ 860.00
CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE															
Total claims	12 - 20 =	0	X \$18.00															
Independent claim:	1 - 3 =	0	X \$80.00															
MULTIPLE DEPENDENT CLAIM(S) (if applicable)			+ \$270.00															
TOTAL OF ABOVE CALCULATIONS =		\$ 860.00																
<input type="checkbox"/> Applicant claims small entity status. See 37 CFR 1.27. The fees indicated above are reduced by 1/2.		\$																
SUBTOTAL =		\$ 860.00																
Processing fee of \$130.00 for furnishing the English translation later than <input type="checkbox"/> 20 <input type="checkbox"/> 30 months from the earliest claimed priority date (37 CFR 1.492(f)).		\$ 0																
TOTAL NATIONAL FEE =		\$ 860.00																
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). \$40.00 per property		+ \$ 40.00																
TOTAL FEES ENCLOSED =		\$ 900.00																
		Amount to be refunded: \$																
		charged: \$																
<p>a. <input checked="" type="checkbox"/> A check in the amount of <u>\$ 900.00</u> to cover the above fees is enclosed.</p> <p>b. <input type="checkbox"/> Please charge my Deposit Account No. <u>13-0235</u> in the amount of \$ _____ to cover the above fees. A duplicate copy of this sheet is enclosed.</p> <p>c. <input checked="" type="checkbox"/> The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. <u>13-0235</u>. A duplicate copy of this sheet is enclosed.</p>																		
<p>NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.</p> <p>SEND ALL CORRESPONDENCE TO: Nicholas J. Tuccillo, Esq. McCormick, Paulding & Huber LLP CityPlace I 185 Asylum Street Hartford, Connecticut 06103-3402</p> <p> SIGNATURE Nicholas J. Tuccillo, Esq. NAME 44,322 REGISTRATION NUMBER</p>																		

CERTIFICATION OF FACSIMILE TRANSMISSION

I hereby certify that this paper is being transmitted
via Facsimile No. (703) 305-3230
on the date shown below to the U.S. PATENT AND
TRADEMARK OFFICE, ATTENTION:

Donna Gren


6/14/02
(Signature of person transmitting paper)

(Date of Signature)

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In the Application of

FERNAND FELGEN

or: GAS WIPING NOZZLE FOR A WIRE
COATING APPARATUS

Serial No.: 10/031,714

I.A. Filing Date: July 3, 2000

)
) Examiner: Gren, D.
) Group Art Unit: Unknown
)
)
)
)
) (Our Docket No. 6157-01WOUS)

Box PCT
ASSISTANT COMMISSIONER OF PATENTS
Washington, D.C. 20231

COMMUNICATION

Dear Examiner Gren:

Pursuant to our Telephonic conference of today, June 14, 2002, enclosed please find the corrected Transmittal Letter to the United States Designated/Elected Office (E.O./EO/US) Concerning a Filing Under 35 U.S.C. 371. (FORM PTO-1390).

No fee is considered due for filing this Amendment. However, authorization is hereby given to charge our Deposit Account No. 13-0235 in the event any additional fees are owed.

Respectfully submitted,

By


Nicholas J. Tuccillo
Attorney for Applicants
Registration No. 44,322

McCormick, Paulding & Huber LLP
C. tyPlace II, 185 Asylum Street
Hartford, Connecticut 06103-4102
Tel. (860) 549-5290

10/031714
531 Rec'd PCT/PTC 18 JAN 2002

"EXPRESS MAIL" MAILING LABEL NO. EV024353308US
DATE OF DEPOSIT: January 18, 2002

I HEREBY CERTIFY THAT THIS PAPER OR FEE IS BEING
DEPOSITED WITH THE UNITED STATES POSTAL SERVICE
"EXPRESS MAIL POST OFFICE TO ADDRESSEE" SERVICE UNDER
37 C.F.R. 1.10 ON THE DATE INDICATED ABOVE AND IS
ADDRESSED TO THE COMMISSIONER OF PATENTS AND
TRADEMARKS, WASHINGTON, D.C. 20231.

Mary E. Dionne

(TYPED OR PRINTED NAME OF PERSON MAILING PAPER OR FEE)


(SIGNATURE OF PERSON MAILING PAPER OR FEE)

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In the Application of)
FERNAND FELGEN) Examiner: Not Assigned
on: GAS WIPING NOZZLE FOR A WIRE) Group Art Unit: Unknown
COATING APPARATUS)
Serial No.: Unknown)
Filed on: Concurrently herewith) (Our Docket No. 6157-01WOUS)

Box PCT
ASSISTANT COMMISSIONER OF PATENTS
Washington, D.C. 20231

PRELIMINARY AMENDMENT

Dear Sir:

Prior to calculating the filing fee and examining the application, please amend the above-referenced patent application as follows:

In the Specification:

Page 1

Please replace after the title, but before line 1, with the following: FIELD OF THE INVENTION.

Page 1

Please insert, between lines 2 and 3, the following: BACKGROUND OF THE INVENTION.

Page 2

Please replace line 1 with the following: SUMMARY OF THE INVENTION.

Page 2

Please delete line 3, "General description of the invention".

Page 4

Please replace line 1, with the following: BRIEF DESCRIPTION OF THE DRAWINGS.

Page 4

Please insert, between lines 7 and 8, the following: DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT.

Page 5

Please replace the paragraph at page 5, lines 9-14 with the following:

The configuration shown in Fig. 3 is e.g. suitable for temperature or inductive sensors. The four sensors 36 deliver four signals which are permanently compared to each other by the position detecting means. When the wire 12 is in the center of the passage 16, i.e. aligned along the central axis 20, the four sensors 36 deliver the same signal. Hence, if one of the signals differs from the others, the wire 12 has deviated from the central axis 20.

In the Claims:

Please cancel existing Claims 1-12.

Please add the following new Claims 13-24:

13. A gas wiping nozzle for a wire coating apparatus comprising:
an inlet portion defining a converging inlet passage for a coated wire that is axially drawn through said gas wiping nozzle;
a wiping portion defining a wiping passage for said coated wire, downstream and in axial extension of said inlet passage, said wiping portion including gas outlet means surrounding said wiping passage for blowing wiping gas onto said coated wire; and
a protruding annular lip arranged between said converging inlet passage and said wiping passage, wherein said annular lip defines a passage for said coated wire that is narrower than said wiping passage, so that said gas outlet means in said wiping passage is protected by said protruding annular lip against direct contact with said coated wire, which is axially drawn through said passages of said gas wiping nozzle.
14. The gas wiping nozzle as claimed in claim 13, further comprising contact detecting means for detecting a coated wire contacting said annular lip.
15. The gas wiping nozzle as claimed in claim 14, wherein said contact detecting means includes an electrically conductive ring arranged in an electrically insulated manner in said annular lip.
16. The gas wiping nozzle as claimed in claim 13, further comprising position detecting means for detecting a coated wire that deviates from the central axis of said passages in said wiping nozzle.
17. The gas wiping nozzle as claimed in claim 16, wherein said position detecting means includes a thermal and/or inductive and/or optical sensor.
18. The gas wiping nozzle as claimed in claim 16, wherein said position detecting means includes at least one optical sensor and one laser.

19. The gas wiping nozzle as claimed in claim 13, further comprising an annular gas equalization chamber that is in communication with said gas outlet means.
20. The gas wiping nozzle as claimed in claim 19, further comprising at least one pressure sensor for measuring the wiping gas pressure in said equalization chamber.
21. The gas wiping nozzle as claimed in claim 19, further comprising a turbine rotor arranged in said equalization chamber so as to be rotated by wiping gas injected into said equalization chamber.
22. The gas wiping nozzle as claimed in claim 21, wherein said turbine rotor defines a passage for said coated wire, downstream and in axial extension of said wiping section.
23. The gas wiping nozzle as claimed in claim 22, wherein:
said gas outlet means includes an annular slit defined between upper and lower annular surfaces;
said upper annular surface is a surface of said turbine rotor; and
at least one cleaning means is attached to said upper annular surface so as to clean said annular slit while said turbine rotor is rotated.
24. The gas wiping nozzle as claimed in claim 21, further comprising rotation sensing means for measuring the number of revolutions per unit of time of said turbine rotor.

After the claims, please insert the following Abstract on a separate page:

ABSTRACT

A gas wiping nozzle for a wire coating apparatus includes an inlet portion defining a converging inlet passage for a coated wire that is axially drawn through the gas wiping nozzle. A wiping portion is further included and defines a wiping passage for the coated wire, downstream and in an axial extension of the inlet passage. The

wiping portion has a gas outlet surrounding the wiping passage for blowing wiping gas onto the coated wire. A protruding annular lip is arranged between the converging inlet passage and the wiping passage, and the annular lip defining a passage for the coated wire that is narrower than the wiping passage so that the gas outlet means in the wiping passage is protected by the protruding annular lip against direct contact with the coated wire which is axially drawn through the passages of the wiping gas.

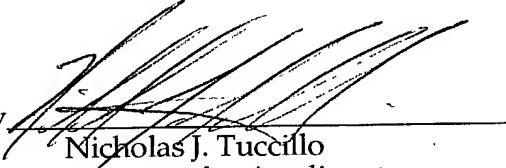
Applicants submit this Preliminary Amendment to eliminate any multiple dependent claims and to place the application in better U.S. form for prosecution.

Applicants therefore respectfully request examination of the above-referenced amended application, as now amended.

No fees are considered to be due; however, if it is determined that payment of a fee is required, please charge our deposit account No. 13-0235.

Respectfully submitted,

By


Nicholas J. Tuccillo
Attorney for Applicants
Registration No. 44,322

McCORMICK, PAULDING & HUBER LLP
CityPlace II, 185 Asylum Street
Hartford, Connecticut 06103-4102
Tel. (860) 549-5290

10/031714
531 Rec'd PCT/ 18 JAN 2002

Version with Markings to Show Changes Made

A marked-up version of the amendments are shown below showing additions with underlining and deletions between brackets.

In the Specification:

Page 1

The replacement line after the title but before line 1 is as follows: [Introduction]
FIELD OF THE INVENTION.

Page 2

The replacement line 1 is as follows: [Object of the Invention] SUMMARY OF THE INVENTION.

Page 4

The replacement line 1 is as follows: [Detailed description with respect to the figures] BRIEF DESCRIPTION OF THE DRAWINGS.

Page 5

The replacement paragraph at page 5, lines 9 - 14 is as follows: The configuration shown in Fig. 3 is e.g. suitable for temperature or inductive sensors. The four sensors [26] 36 deliver four signals which are permanently compared to each other by the position detecting means. When the wire 12 is in the center of the passage 16, i.e. aligned along the central axis 20, the four sensors 36 deliver the same signal. Hence, if one of the signals differs from the others, the wire 12 has deviated from the central axis 20.

Gas wiping nozzle for a wire coating apparatus

Introduction

The present invention relates to a gas wiping nozzle for a wire coating apparatus.

A metallic wire is commonly coated by passing the wire through a bath of molten metal, such as molten zinc, molten zinc alloy, or molten aluminum. After emerging from the molten metal bath, the wire is drawn through a gas wiping nozzle, in order to obtain a uniform metal coating upon the substrate metal, by wiping the excess of molten metal.

Such a gas wiping nozzle is e.g. disclosed in EP-A-0 357 297. The nozzle has an upper annular part and a lower annular part. Each of the annular parts have an upper and lower surface meeting in a substantially sharp annular edge, adjacent surfaces of the upper and lower annular parts defining between them an annular gas passage operatively connected to a source of pressurized gas and terminating in an annular gas orifice. The edges and the gas orifice define a wire orifice through which passes a wire coated with molten metal, which is therein wiped by the gas blown through the gas passage.

This gas wiping nozzle is efficient for wiping excess molten metal from the surface of a wire, but it can be easily damaged by molten metal. Indeed, during the coating process, the molten metal coated wire is generally drawn along a drawing axis centered in the wire orifice. The molten metal coated wire can deviate from its drawing axis and contacts directly the annular gas passage, the molten metal thence filling in the gas passage, solidifying therein and therefore obstructing it. From that point on, the molten metal coated wire passing through the nozzle is not properly wiped and does no longer meet the quality requirements. The gas wiping nozzle has to be cleaned or replaced.

Object of the invention

The object of the present invention is to provide a gas wiping nozzle which avoids or alleviates the above-mentioned problems. According to the present invention, this object is achieved by a gas wiping nozzle according to claim 1.

General description of the invention

In accordance with the present invention, a gas wiping nozzle for a wire coating

- 5 apparatus comprises a passage for a wire being drawn therethrough along a central axis. This passage includes a converging inlet section through which the wire coated with molten metal enters into the gas wiping nozzle, and a wiping section arranged downstream of the inlet section. The wiping section has a gas outlet means therein, which surrounds the passage for blowing wiping gas
- 10 against the surface of the wire being drawn therethrough. In accordance with an important aspect of the present invention, a protruding annular lip is arranged between said converging inlet section and said wiping section. This lip defines a narrower passage than said wiping section, so as to protect the gas outlet means in the wiping section from direct contact with the coated wire. The gas
- 15 outlet means may include for example a continuous annular slit or several contiguous slits or orifices.

Such a lip arranged between the converging inlet section and the wiping section of a nozzle provides an efficient protection for the gas outlet means against direct contact with the molten metal coated wire. If a wire deviates from the

- 20 central axis, it will contact the lip and not the gas outlet means. Moreover, the molten metal will remain under the lip and flow down to the diverging section, since the lip protrudes into the passage. The molten metal will consequently not fill the gas outlet means, and the gas wiping nozzle will not have to be cleaned or replaced.

- 25 Advantageously, the gas wiping nozzle includes contact detecting means for detecting a wire contacting said lip. The contact detecting means may include an electrically conductive ring arranged in an electrically insulated manner in the lip. It is easily understood that the metallic ring together with the wire may serve

as a switch for the contact detecting means. A wire deviating from the central axis and contacting the lip may trigger an alarm so that the operator will be warned and can eliminate the malfunction.

The gas wiping nozzle may also include position detecting means surrounding said passage, for detecting a wire deviating from the central axis of said passage. The position detecting means preferably includes temperature, inductive or optical sensors, or laser means. Thereby, the operator can be warned of an imminent malfunction and immediately solve it.

Advantageously, a gas equalization chamber surrounds the passage in the gas wiping nozzle and communicates with the gas outlet means. The equalization chamber acts for dynamic pressure homogenization at the entrance of the gas outlet means, thus contributing to an axisymmetric wiping gas distribution in the passage.

The gas wiping nozzle may include pressure sensors for measuring the wiping gas pressure in the equalization chamber. It becomes thereby possible to correlate the coating thickness and the wiping gas pressure.

In a first embodiment, a turbine rotor is arranged in the equalization chamber so as to be rotated by wiping gas injected into the equalization chamber. The turbine rotor along with the equalization chamber further contribute to a more homogeneous wiping gas distribution. The more homogeneous the air blast, the better the quality of the coating.

In a second embodiment, the turbine rotor defines part of the passage downstream of the wiping section. The gas outlet means then includes an annular slit defined between upper and lower annular surfaces, the upper annular surface being a surface of the turbine rotor. At least one cleaning means is then preferably attached to the upper annular surface so as to clean the annular slit while the turbine rotor is rotated by the wiping gas.

Rotation sensing means for measuring the number of revolutions per unit of time of the turbine rotor may also be used to correlate the coating thickness and the number of revolutions per unit of time.

Detailed description with respect to the figures

The present invention will be more apparent from the following description of a not limiting embodiment with reference to the attached drawings, wherein

Fig.1: is a longitudinal section of a first gas wiping nozzle;

Fig.2: is a longitudinal section of the lip of the gas wiping nozzle of Fig.1;

5 Fig.3: is a section AA of the gas wiping nozzle of Fig.1;

Fig.4: is a longitudinal section of a second gas wiping nozzle;

Fig.5: is a longitudinal section of a third gas wiping nozzle.

Fig.1 shows a longitudinal section of a gas wiping nozzle 10 that is used in a wire coating apparatus for wiping excess molten metal off the surface of a wire

10 coated with molten metal. A wire 12, represented by its axis, is drawn upwards from a molten metal bath 14 and passes through the nozzle 10 via a passage 16. It is drawn upwards by schematically represented drawing means 18, along a substantially vertical central axis 20, as shown by the arrow 21. The wire 12 enters the nozzle 10 through a converging inlet section 22, wherein the section

15 of the passage 16 decreases in the drawing direction. A wiping section 24 situated downstream of the inlet section 22 comprises an annular gas outlet slit 26, for blowing wiping gas against the surface of the molten metal coated wire 12 passing through the nozzle 10.

It shall be appreciated that a protruding annular lip 28 is arranged between the
20 inlet section 22 and the wiping section 24, preferably just beneath the gas outlet slit 26. Such a lip 28 provides a localized section reduction just before the gas outlet slit 26, which is thereby protected from direct contact with the molten metal coated wire 12. Indeed, a wire 12 deviating from the central axis 20 cannot come into contact with the gas outlet slit 26 since the lip 28 will keep it
25 spaced from the gas outlet slit 26.

Fig.2 shows a longitudinal section of the lip 28. In order to detect a wire 12 contacting the lip 28, a metallic ring 30 is arranged in an annular groove 32 in the lip 28. The metallic ring 30 is insulated from the body of the nozzle 10, and in particular from the lip 28, by insulating material 34 inserted in the annular
30 groove 32 between the ring 30 and the nozzle 10. It can easily be understood

that the metallic ring 30 and the wire 12 serve as a switch that triggers an alarm in case of contact between the wire 12 and the lip 28. An operator warned by the alarm can stop or intervene in the coating process to repair the malfunction.

Turning now to Fig.3, four sensors 36 are arranged at the same level downstream the gas outlet slit 26, in the passage walls, and are regularly spaced about the circumference of the passage 16. These four sensors 36 are part of position detecting means, enabling the detection of a wire 12 deviating from the central axis 20, before it contacts the lip 28.

The configuration shown in Fig.3 is e.g. suitable for temperature or inductive sensors. The four sensors 36 deliver four signals which are permanently compared to each other by the position detecting means. When the wire 12 is in the center of the passage 16, i.e. aligned along the central axis 20, the four sensors 36 deliver the same signal. Hence, if one of the signals differs from the others, the wire 12 has deviated from the central axis 20.

It is possible to detect the position of the wire 12 by using optical sensors, such as light beams and photoelectric cells.

A further possibility is the use of two perpendicular laser beams impinging on the wire 12. When a wire 12 deviates from the central axis 20, the laser beam reflects on the opposite passage wall instead of reflecting on the wire 12. The return time of the laser beam increases, thereby signaling the deviation of the wire 12.

Fig.4 shows a longitudinal section of a second nozzle 38. As in Fig.1, a wire 12 is drawn through the nozzle 38 along a central axis 20, via a passage 16, in the direction indicated by arrow 21. The wire 12 enters the nozzle 38 through a converging inlet section 40, passes through a wiping section 42, then through a tubular section 44, and exits the nozzle 38 through a diverging section 46. The wiping section 42 comprises a gas outlet slit 26 for wiping excess molten metal off the surface of the wire 12. A lip 28 equipped with a metallic ring 30, similar to the lip of Fig.1, is located just before the gas outlet slit 26. As explained above, the lip 28 protects the gas outlet slit 26 from direct contact with the wire 12. The arrow 48 indicates a gas inlet 49 in an equalization chamber 50 surrounding the

passage 16 and communicating with the gas outlet slit 26. A turbine rotor 52 is installed in the equalization chamber 50 and surrounds the passage 16 as well. Wiping gas, e.g. nitrogen (N₂), is supplied to the equalization chamber 50 through the gas inlet 49 and impinges on the turbine rotor 52, which is thereby 5 rotated. The equalization chamber 50 and the turbine rotor 52 facilitate the homogenization of the pressure of the wiping gas, before being blown through the gas outlet slit 26.

Reference sign 53 generally indicates a pressure sensor installed in the body of the nozzle 38, for measuring the wiping gas pressure in the equalization 10 chamber 50. It is thereby possible to correlate the thickness of the molten metal coating and the wiping gas pressure in the equalization chamber 50.

It shall be noted that the nozzle 10 of Fig.1 is also equipped with an equalization chamber 50 and pressure sensors 53.

Besides, a rotation sensing means is installed in the nozzle 38. The rotation 15 sensing means comprises e.g. a magnet 54 embedded in the turbine rotor 52, and an inductive sensor 56 is installed in the body of the nozzle 38 so as to be on the trajectory of the magnet 54. The inductive sensor 56 detects the presence of the magnet 54 once per revolution. It is thereby possible to determine the number of revolutions per unit of time, and thereby to correlate the thickness 20 of the molten metal coating with the number of revolutions per unit of time. The flow rate, which is a function of the speed of the turbine rotor 52 and the pressure, may also be determined.

Fig. 5 shows a third embodiment of a gas wiping nozzle 58. As in Fig.4, a wire 12 is drawn through the nozzle 58 along a central axis 20, via a passage 16, in 25 the direction indicated by arrow 21. The structure of the passage 16 is different: the wire 12 enters the nozzle 58 through a converging inlet section 60, passes through a wiping section 62, then through a diverging section 64. The wiping section 62 comprises a gas outlet slit 26 for wiping excess molten metal of the surface of the wire 12. A lip 28 equipped with a metallic ring 30, similar to the lip 30 of Fig.1, is located just before the gas outlet slit 26. As explained, the lip 28 protects the gas outlet slit 26 from direct contact with the wire 12.

In this third embodiment, the equalization chamber 50 is isolated from the passage 16 by a turbine rotor 66. In other words, a central channel through the turbine rotor 66 defines a part of the passage 16. It should be noted that the gas outlet slit 26 is defined by upper and lower annular surfaces 68 resp. 70. The 5 upper annular surface 68 is part of the turbine rotor 66. Hence, when the turbine rotor 66 is rotated, due to the wiping gas in the equalization chamber 50, the upper 68 annular surface is rotated as well. Reference sign 72 generally identifies a small brush. Three radial brushes 72 are preferably attached to the upper annular surface 68. When the turbine rotor 66 is rotated, the brushes 72 10 sweep the lower annular surface 70 and the gas blast clears the gas wiping slit 26. This third nozzle 58 can be regarded as a self-cleaning nozzle 58. The rotation of the turbine rotor 66 may be stopped by electromagnetic or mechanical means (not shown), in order to allow cleaning only when desired.

It shall be noted that each of the gas wiping nozzles respectively 10, 38 and 58 15 may be embodied as a split nozzle, consisting of two or more body parts. Thus, the wire does not have to be threaded through the passage of the nozzle, but rather the body parts are separated while the wire is positioned in the coating apparatus, and the body parts are then brought together in abutment about the wire.

Claims

1. A gas wiping nozzle (10, 38, 58) for a wire coating apparatus, comprising a passage (16) for a wire (12) coated with molten metal being drawn therethrough along a central axis (20), said passage (16) including:

a converging inlet section (22, 40, 60) through which said wire (12) coated with molten metal enters into said gas wiping nozzle (10, 38, 58);

a wiping section (24, 42, 62) arranged downstream of said inlet section (22, 40, 60) and having therein gas outlet means (26) surrounding said passage (16) for blowing wiping gas against the surface of said wire (12) being drawn therethrough;

10 **characterized by**

a protruding annular lip (28) arranged between said converging inlet section(22, 40, 60) and said wiping section (24, 42, 62), wherein said lip (28) defines a narrower passage (16) than said wiping section (24, 42, 62), so as to protect said gas outlet means (26) in said wiping section(24, 42, 62) from direct contact with the coated wire (12).

2. The gas wiping nozzle as claimed in claim 1, characterized by contact detecting means for detecting a wire (12) contacting said lip (28).

3. The gas wiping nozzle as claimed in claim 2, characterized in that said contact detecting means includes an electrically conductive ring (30) arranged in an electrically insulated manner in said lip (28).

20 4. The gas wiping nozzle as claimed in claim 1, 2 or 3, characterized by position detecting means surrounding said passage (16), for detecting a wire (12) deviating from said central axis (20) in said passage (16).

25 5. The gas wiping nozzle as claimed in claim 4, characterized in that said position detecting means includes thermal and/or inductive and/or optical sensors (36).

6. The gas wiping nozzle as claimed in claim 4 or 5, characterized in that said position detecting means includes at least one optical sensor and one laser.
7. The gas wiping nozzle as claimed in any of the preceding claims, characterized by a gas equalization chamber (50) surrounding said passage (16) in said nozzle (10, 38, 58) and communicating with said gas outlet means (26).
- 5 8. The gas wiping nozzle as claimed in claim 7, characterized by pressure sensors (53) for measuring the wiping gas pressure in said equalization chamber (50).
9. The gas wiping nozzle as claimed in claim 7 or 8, characterized by a turbine 10 rotor (52, 66) arranged in said equalization chamber (50) so as to be rotated by wiping gas injected into said equalization chamber (50).
10. The gas wiping nozzle as claimed in claim 9, characterized in that said turbine rotor (66) defines part of said passage (16) downstream of said wiping section (62).
- 15 11. The gas wiping nozzle as claimed in claim 10, characterized in that said gas outlet means (26) includes an annular slit defined between upper and lower annular surfaces (68 resp. 70), the upper annular surface (68) being a surface of said turbine rotor (66); and in that at least one cleaning means (72) is attached to said upper annular surface (68) so as to clean the annular slit 20 while the turbine rotor (66) is rotated.
12. The gas wiping nozzle as claimed in claims 9 to 11, characterized by rotation sensing means for measuring the number of revolutions per unit of time of the turbine rotor (52, 66).

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
1 February 2001 (01.02.2001)

PCT

(10) International Publication Number
WO 01/07675 A1

(51) International Patent Classification⁷: C23C 2/20

(21) International Application Number: PCT/EP00/06176

(22) International Filing Date: 3 July 2000 (03.07.2000)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
90421 23 July 1999 (23.07.1999) LU

(71) Applicant (*for all designated States except US*): TREFILARBED BISSEN S.A. [LU/LU]; Route de Finsterthal, Boîte Postale 16, L-7703 Bissen (LU).

(72) Inventor; and

(75) Inventor/Applicant (*for US only*): FELGEN, Fernand [LU/LU]; 14, rue J. B. Neuens, L-7553 Mersch (LU).

(74) Agents: SCHMITT, Armand et al.; Office Ernest T. Freylinger S.A., Boîte Postale 8, L-8001 Strassen (LU).

(81) Designated States (*national*): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CR, CU, CZ, DE, DK, DM, DZ, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW.

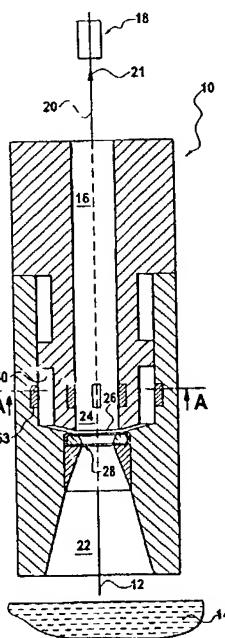
(84) Designated States (*regional*): ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

Published:

— With international search report

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: GAS WIPING NOZZLE FOR A WIRE COATING APPARATUS



(57) Abstract: A gas wiping nozzle (10, 38, 58) for a wire coating apparatus comprises a passage (16) for a wire (12) being drawn therethrough along a central axis (20). The passage (16) includes a converging inlet section (22, 40, 60) through which the wire (12) coated with molten metal enters into the gas wiping nozzle (10, 38, 58), and a wiping section (24, 42, 62) arranged downstream of said inlet section (22, 40, 60) and having therein gas outlet means (26) surrounding the passage (16) for blowing wiping gas against the surface of said wire (12) being drawn therethrough. A protruding annular lip (28) is arranged between the converging inlet section (22, 40, 60) and the wiping section (24, 42, 62); the lip (28) defines a narrower passage (16) than the wiping section (24, 42, 62), so as to protect the gas outlet means (26) in the wiping section (24, 42, 62) from direct contact with the coated wire (12).

WO 01/07675 A1

1 / 2

Fig. 1

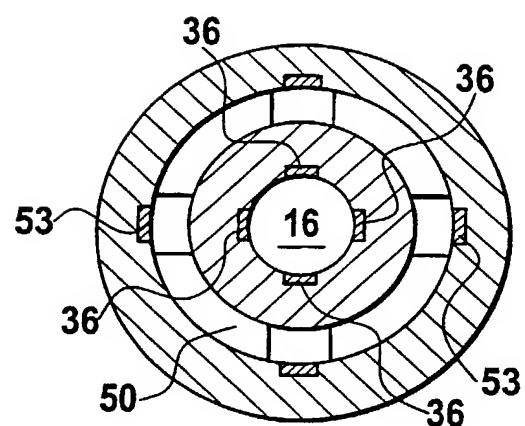
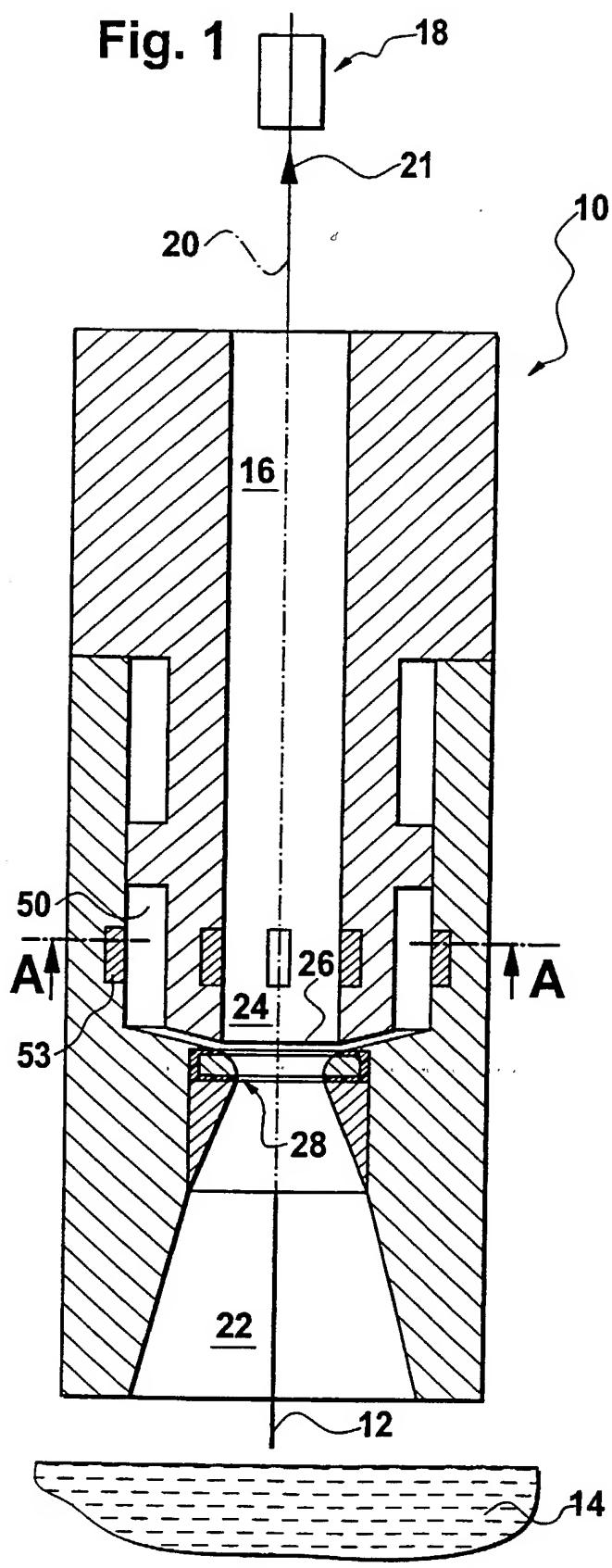


Fig. 3

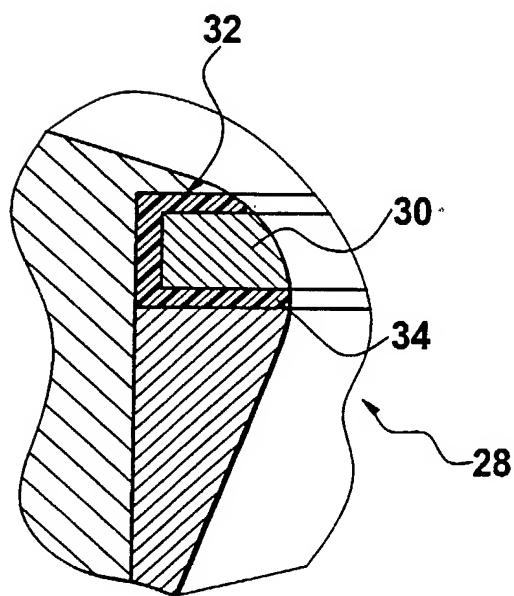


Fig. 2

2 / 2

Fig. 4

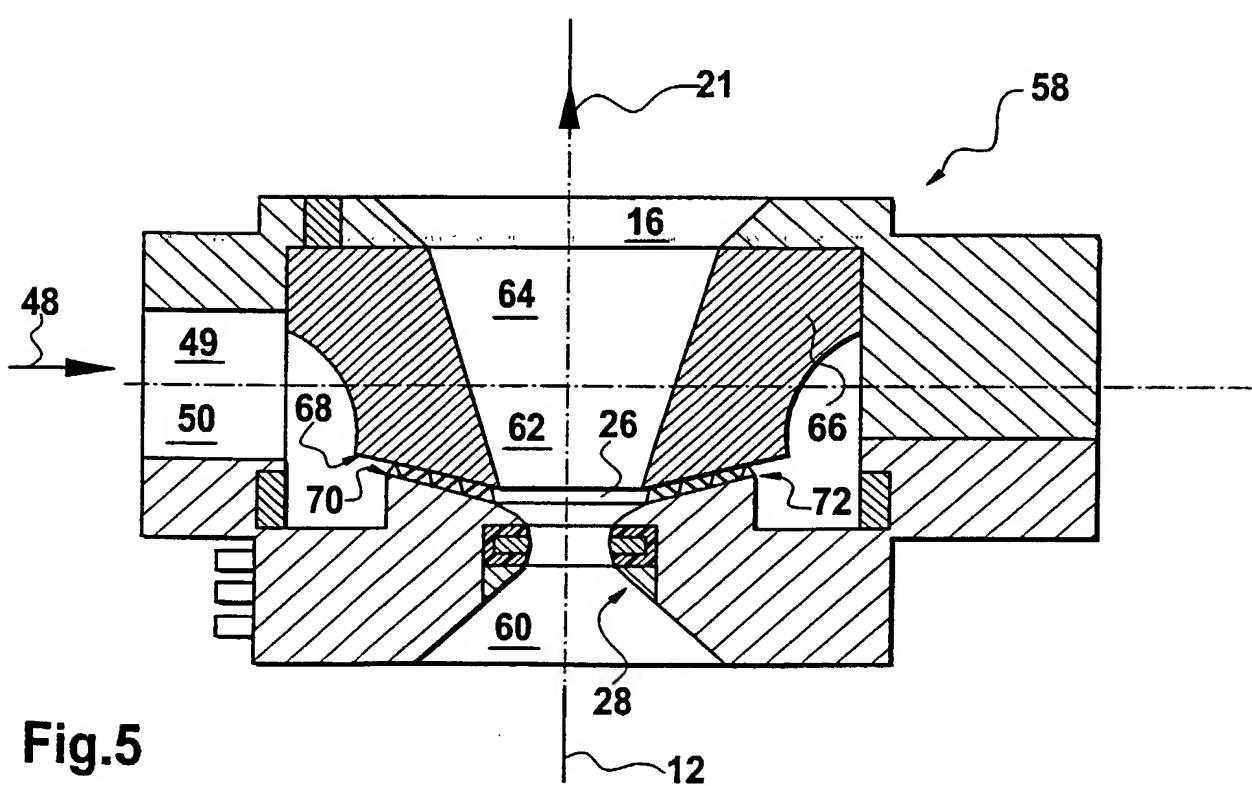
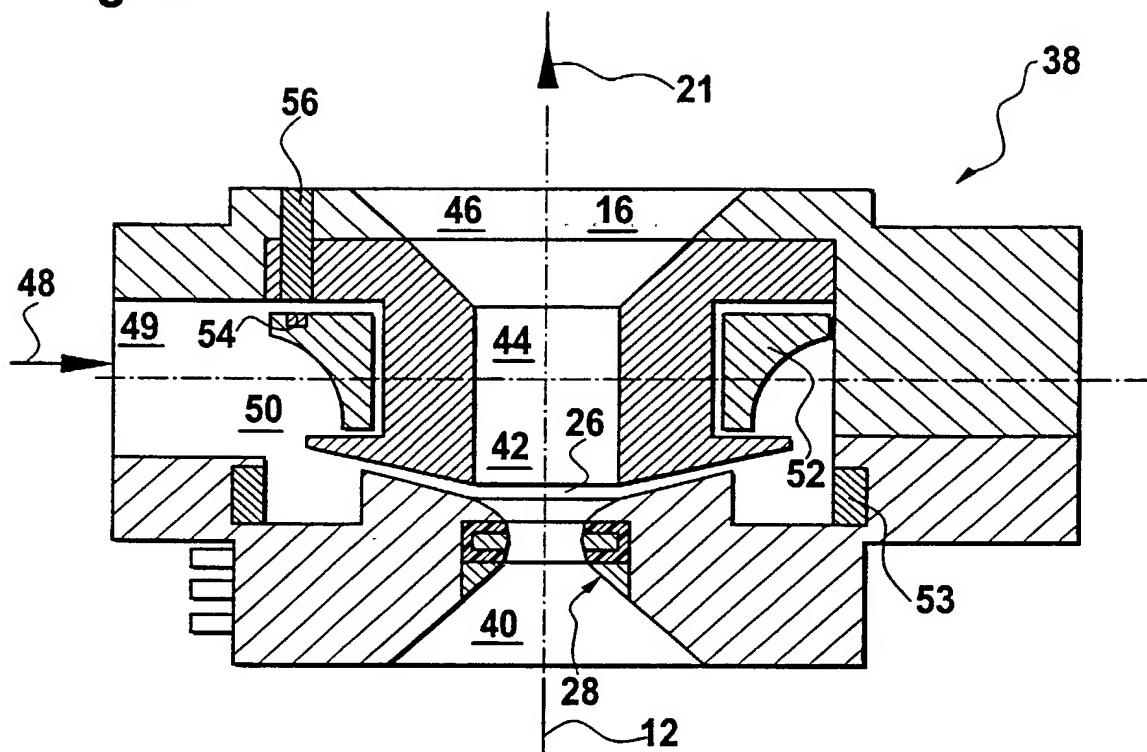


Fig. 5

**DECLARATION, POWER OF ATTORNEY AND
APPOINTMENT OF DOMESTIC REPRESENTATIVE**

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name,

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled

GAS WIPING NOZZLE FOR A WIRE COATING APPARATUS,
the specification of which

(Check X is attached hereto.
one)

_____ was filed on _____
as Application Serial No. _____
and was amended on _____
(if applicable)

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose to the U.S. Patent and Trademark Office all information known to be material to the patentability of this application in accordance with Title 37, Code of Federal Regulations, §§1.56 and 1.63(d).

I hereby claim foreign priority benefits under Title 35, United States Code, §119 of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed:

Prior Foreign Application(s):

<u>LU 90421</u>	<u>Luxembourg</u>	<u>23/07/99</u>	<u>Priority Claimed</u>
(Number)	(Country)	(Day/Month/Year Filed)	Yes

Yes/No

I hereby claim the benefit under Title 35, United States Code, §120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code, §112, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, §§1.56 and 1.63(d) which occurred between the filing date of the prior application and the national or PCT international filing date of this application:

(Application Serial No.)	(Filing Date)	(Status - Patented, pending, abandoned)
--------------------------	---------------	--

POWER OF ATTORNEY

I hereby appoint Donald K. Huber, Registration No. 18,686; Theodore R. Paulding, Registration No. 19,294; John C. Hilton, Registration No. 22,965; Frederick J. Haesche, Registration No. 24,529; John C. Linderman, Registration No. 24,420; J. Kevin Grogan, Registration No. 31,961; Arthur F. Dionne, Registration No. 23,093; Daniel G. Mackas, Registration No. 38,541; Richard R. Michaud, Registration No. 40,088; Marina F. Cunningham, Registration No. 38,419; Susan C. Oygard, Registration No. 42,969; Nicholas J. Tuccillo, Registration No. 44,322; Stephen P. Scuderi, Registration No. 42,136; Michael T. Clorite, Registration No. 44,620; Wm. Tucker Griffith, Registration No. 44,726; Mary-Jacq Holroyd, Registration No. 41,846; Richard D. Getz, Registration No. 36,147; William B. Gowanlock, Registration No. 41,794; Donald J. MacDonald, Registration No. 42,823, all of the firm of McCormick, Paulding & Huber LLP, CityPlace II, 185 Asylum Street, Hartford, Connecticut 06103-4102, telephone (860) 549-5290, as my attorneys to prosecute this application, to make alterations

(18)

and amendments therein, to receive the patent and all correspondence relating to this application, and to transact all business in the U.S. Patent and Trademark Office connected therewith, and the said attorneys are hereby given full power of substitution and revocation.

APPOINTMENT OF DOMESTIC REPESENTATIVE

The above-identified attorneys, also known as McCORMICK, PAULDING & HUBER LLP, whose postal address is CityPlace II, 185 Asylum Street, Hartford, Connecticut 06103-4102, United States of America, are hereby designated Applicant's representative upon whom notices or process in proceedings affecting the patent may be served. Said firm shall take instructions from my foreign patent agents in all matters affecting this application and the patent.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

F-00

Fernand FELGEN

Full name of sole or first inventor

Inventor's Signature

18.12.2001
Date

Luxembourg
Citizenship

NLX

Full name of second joint
inventor, if any

Inventor's Signature

Date

Citizenship

14 rue J.B. Neuens
L-7553 Mersch
Luxembourg
Residence Address

Residence Address

Same as Above
Post Office Address

Same as Above
Post Office Address